

**Georgia Department of Transportation
Office of Materials and Research**

**Standard Operating Procedure (SOP) 41
Approval of Recycled Asphalt Pavement (RAP) for use in Asphalt Mixtures**

I. GENERAL

The Department approves RAP on a stockpile basis, following the process set forth in these guidelines. RAP from a currently approved stockpile may be included as an ingredient in dense-graded asphalt mixtures designed and approved under Section 828 of the Standard Specifications. The contractor's responsibilities in the process are as follows:

- To obtain the Department's approval of all RAP prior to its use on a State project and to deliver test data and samples as required
- To monitor and preserve the quality and uniformity of the approved material during storage and handling, adding no unapproved material to the existing stockpile except as authorized below
- To comply with the Department's requirements regarding replenishment of approved stockpiles

The Department will approve RAP based on its composition and variability in gradation and asphalt content, as explained below, and on visual inspections of the stockpile, which the Department may conduct at its discretion. The Department may withdraw approval of a stockpile if these Guidelines are not followed in good faith.

The Maximum Percentage Allowed in a mix design will be based on these criteria and on the category of the RAP source, as defined in Parts V and VIII below. The amount of RAP allowed in a mix is also limited according to the type of plant in which it will be produced.

Approval of a material pertains to its condition as tested and sampled after final processing. If an approved material is to be re-processed later in a manner which appreciably alters the gradation, the material must be re-approved in its reprocessed condition. This does not apply to removal or re-crushing of oversize particles during production.

Nothing in these guidelines shall relieve the contractor of responsibility for mixture quality or set aside any requirement of the Acceptance Plans for Gradation and Asphalt Content, Section 400.3 of the Standard Specifications.

II. APPROVAL PROCESS

Qualified asphalt producers (listed in QPL 45) may submit requests for RAP stockpile approval to the State Bituminous Construction Engineer, Office of Materials and Research, in the format given in the Attachment below. The requester shall deliver samples and test results as prescribed in Part III. The Office of Materials and Research will test the samples to identify their mineral components and to determine the effective specific gravity, gradation, asphalt cement content and viscosity, and variability of composition. The Office of Materials and Research may adjust the amount and nature of testing required according to the history and nature of the material.

Upon completion of testing and, if applicable, visual inspection, the State Materials and Research Engineer will approve or disapprove the material by letter and will assign a Stockpile Identification Number for each approved RAP stockpile. Note: The contractor's average gradation and asphalt content, as listed in the approval letter, shall be the gradation used in subsequent mix designs. The approval letter will state the applicable limits on the use of the material in mix designs and will summarize the Department's findings, listing the average gradation

and asphalt content from the contractor's tests and the corresponding values found by the Department. Where the Maximum Percentage Allowed is low due to variability, the contractor may elect to improve the uniformity of the material by further processing and may again sample, test, and request approval for the material.

No material shall be added to a stockpile after it has been approved, except as provided in Parts V, VII, and VIII below.

III. SAMPLING, TESTING, AND SUBMITTALS

III.A. Standard approval procedure

Except as otherwise provided under Part E below, the contractor shall obtain random samples representative of the entire stockpile and shall have each sample tested for gradation and asphalt content according to GDT-38 and either GDT-83 or GDT-125. The material sampled must be in its final condition, after all crushing and screening. At least one sample shall be obtained for each 1,000 tons of RAP, with a minimum of five samples per stockpile. Sampling shall be performed according to GSP-2, "Sampling Procedure for Coarse Aggregates." The minimum sample size (after quartering) for tests on RAP samples is 1,500 g. except for samples containing particles more than one inch in diameter, for which the minimum is 2,000 g.

To request approval of a RAP stockpile, submit the following documents and samples to the Office of Materials and Research. It is the requester's responsibility to correctly address, label, and deliver these submittals:

- Contractor's Request for RAP Stockpile Approval (Complete the form attached to this document.)
- Test reports of the tests prescribed above
- A drawing of the plant site showing the location of the stockpile to be approved *and all other stockpiles on the premises*
- Five bagged samples (regardless of stockpile size), approximately 25 pounds each, taken randomly from five different points in the stockpile, numbered sequentially, and *labeled with the plant location and the name of the contractor*
- A quartered sample weighing 1500 to 2000 grams to be used for abrasion recovery testing is to be submitted with the five bagged samples
- Sample cards (DOT 170, which are available upon delivery) filled out by the requester and placed in each sample bag.

Mail or deliver the request form, with test reports and site drawing, to:

State Materials Engineer
ATTN: Asphalt Design Lab, Room 211
Office of Materials and Research
15 Kennedy Drive, Forest Park, GA 30297

Deliver fully labeled samples, with completed sample cards, to the Receiving Clerk, Loading Dock C, at the above address. (Sample cards may be obtained at Dock C.) Do not attach the request form, test reports, and site drawing to the samples or place them in the sample containers; they must be delivered as indicated above. The Department will not be accountable for samples not properly labeled or for samples not delivered to the Receiving Clerk in person. Samples may be delivered by mail or commercial parcel service, provided that the service requires a signed acknowledgement of delivery.

III.B. Tests and inspections by the Department

The Department shall have the right to observe the collection of samples or to perform the sampling. As a condition of approval, the Department may at any time inspect and sample RAP stockpiles for which approval has been requested and may perform additional quality control tests to determine the consistency and quality of the material. The Department will perform petrographic analyses to determine the aggregate group, percentage of local sand, and presence of deleterious materials and soft particles. For certain projects and applications, the Specifications restrict the use of mix designs which include local sand or Group I aggregates.

The approval letter issued by the Department will include the results of its mixture analysis and effective gravity. However, in preparing mix designs using the approved RAP, mix design technicians may compare their own results with the Department's data but should apply their own data in the design calculations.

IV. STOCKPILE IDENTIFICATION SIGNS

RAP stockpiles shall be identified with posted signs displaying the original stockpile number or the current replenishment number, whichever applies. These signs shall be made of weatherproof material and shall be highly visible. Numerals shall be easily readable from outside the stockpile area. If a stockpile exists in two or more parts, each part must have its own sign.

V. CATEGORIES OF RAP BY SOURCE

V.A. General

For all sources of RAP, the Maximum Percentage Allowed in a mix design will be limited by specification requirements and the criteria given in Part VI below. Requirements for approval of RAP from a single source may be modified in certain cases, and material from sources other than existing highway pavements may be unacceptable.

V.B. Single pavement source

Early approval of material from a single pavement source. When a new stockpile is to consist entirely of millings removed from one existing pavement, the stockpile may, other factors permitting, be approved on the basis of samples taken during the milling and processing operations, prior to completion of milling. The initial stockpile may be approved as either a new stockpile or a new stockpile in continual replenishment status.

Approval in Continual Replenishment status. If the contractor elects to place this stockpile in Continual Replenishment Status, five samples plus one additional sample per thousand tons shall be taken from the processed stockpile after it reaches at least 1,000 tons. The material sampled must be in its final condition, after crushing and screening. As prescribed in Part III above, the contractor shall test one sample per thousand tons and shall deliver the five remaining samples, together with a letter request for approval in Continual Replenishment status, to the address indicated. The stockpile shall be subject to initial approval as prescribed above in Part II. Once approved, it may be replenished without further approvals as provided in Part VIII below. For stockpiles approved for Continual Replenishment, the Maximum Percent Allowed shall remain at the percent determined according to Part VI below.

Approval at a higher Maximum Percent Allowed. For approval at a higher maximum rate, the stockpile shall be sampled as prescribed in Part III above, after the processed stockpile reaches at least 2,000 tons or when the milling and processing operations are at least 40 percent complete, whichever occurs first. The material sampled must be in its final condition, after crushing and screening. Five samples shall be delivered to the Office of Materials and Research with the contractor's test results and a letter request for approval, as prescribed in Parts II and III. The material milled and processed subsequent to the first stockpile shall be kept separate from the approved stockpile. The contractor may request approval of this material as replenishment of the original stockpile, in increments of 2,000 tons or more as it is processed.

V.C. Multiple sources

This category includes RAP from more than one project and also asphalt mixture produced but not placed, when the mixture is composed of acceptable ingredients. These materials should be processed and stockpiled so as to combine and blend them to the fullest practical extent. Criteria for approval and the Maximum Percentage Allowed in mix designs are given in Part VI below.

V.D. Heterogeneous or contaminated material not allowed

When milling to recycle asphalt pavement; traffic detection loops, raised pavement markers and other detrimental debris must be separated and discarded prior to stockpiling the RAP for approval for use in GDOT

asphaltic concrete mixtures.

No material other than RAP from an approved stockpile shall be included in mixtures for State projects. The following materials are specifically excluded:

- Material contaminated with foreign matter such as liquids, soil, concrete, or debris
- Plant waste, especially waste containing abnormal concentrations of bitumen, drum build-up, or material from spills or plant clean-up operations

The following materials shall not be added to or placed in proximity to an approved stockpile but may be accumulated in a separate stockpile and submitted for approval according to Part III:

- Production mixtures returned to the plant for any reason
- Mis-proportioned mixtures, especially that generated at start-up.

VI. PERCENTAGE OF RAP ALLOWED

The Maximum Percent of RAP allowed in mix designs shall be the lowest percentage determined by the gradation, asphalt content, or asphalt viscosity of the RAP, as established under the criteria in 1 and 2 below. In addition, the use of RAP designs in certain applications may be restricted by the content of natural sand and Group I aggregate or by the plant type, as discussed in 3 and 4.

VI.A. Limits according to range in gradation and bitumen content

The Maximum Percent of RAP Allowed according to gradation and asphalt content shall be based on the ranges in these values as determined by the Department from at least five samples. The Department may base its finding on its own tests or on samples obtained and tested by the contractor. Apparent outliers shall not be considered in determining these ranges. Where one result appears to be unrepresentative of the whole, two or more additional samples shall be tested. The outlying value of all tests shall then be excluded from the range. The maximum percentage of RAP allowable shall be the lowest percentage determined according to Table 1 below.

Table 1: Maximum Percent RAP According to Range in Test Results

<i>If ranges in asphalt content and gradation are equal to or less than:</i>						
% asphalt cement	≤ 0.65	0.66 - 0.90	0.91 - 1.00	1.01 - 1.20	1.21 - 1.30	> 1.30
% passing No 200 Sieve	≤ 5.0	5.1 - 7.0	7.1 - 7.75	7.76 - 8.0	8.1 - 8.8	> 8.8
% passing control sieves	≤ 8.0	8.1 - 13	13.1 - 18	13.1 - 18	18.1 - 20.0	> 20.0
the maximum % RAP allowed is:						
Max	30%	25%	20%	15%	10%	

***NOTE: These allowances notwithstanding, the Contractor is required to maintain the mixture within the Mixture Control Tolerances of Section 828.**

VI.B. Limits according to viscosity

For stockpiles to be approved at a Maximum Percent Allowed ≥ 20 percent, the Department will determine the viscosity of the asphalt cement in the RAP. The percentage allowable in mix designs shall be limited to meet the design criteria for viscosity established in the Standard Specifications.

VI.C. Limits on natural sands and Group I aggregates

Natural sand and Group I aggregates in RAP contribute to the total amounts of these materials in the combined mixture. These amounts are limited by the Specifications according to the type of road in which it may be

placed. The Office of Materials and Research will determine these amounts by petrographic measurements and may restrict the use of mix designs accordingly.

VII. REPLENISHMENT OF STOCKPILES

An approved RAP stockpile may, with the approval of the Department, be replenished an unlimited number of times, provided that the material for replenishment meets all requirements for approval and remains within tolerances for gradation and uniformity. The stockpile number for the replenished stockpile shall consist of the original stockpile number plus the letter R and a number to denote the number of times the stockpile has been replenished. The last four digits will indicate the year in which the replenishment is approved.

VII.A. Procedure and approval criteria

The procedure for requesting approval of a stockpile replenishment shall be the same as for approval of an original stockpile, and the material for the replenishment shall meet all criteria for approval as a new stockpile. RAP proposed for replenishment shall be sampled and tested by the Contractor for gradation and asphalt cement as prescribed in Section VI above. The Laboratory shall review these results and perform its own tests, and the largest range shall determine the Maximum Percent Allowed in future mix designs, according to the Table 1 above.

VII.B. Effect of replenishment on existing approved mix designs

Replenishment of a stockpile may render certain mix designs invalid, depending on the percent RAP required in the design and on the difference in average gradation between the old and new stockpiles. A replenished stockpile may be used as the RAP ingredient in an existing approved design provided that:

1. The amount of natural sand in the replenishment stockpile does not cause the design to exceed specified limits. Note: An increase in Group I material present may further restrict the use of designs for surface mixes.
2. the Maximum Percent Allowed for the replenishment stockpile equals or exceeds the percent RAP called for in the mix design. In no case may the Maximum Percent Allowed be exceeded.

However, if a mix design calls for up to 5.0 percent more than the Maximum Percent Allowed for the replenishment, the *design* may be adjusted, with approval, to use the lower percent allowed, provided that the production mixture continues to meet all acceptance criteria. For example, a design which calls for 20 percent RAP may be adjusted and produced with 15 percent if it continues to meet for acceptance.

- c. the difference between the new RAP gradation and the RAP gradation of the design does not change the combined gradation of the design by more than the following limits, where **F** is the RAP fraction of the existing design, expressed in hundredths:

F times the difference on the No. 8 sieve shall not exceed 2.0 percent, and
F times the difference on the other control sieves shall not exceed 2.5 percent.

Example: A particular design includes 20% RAP, and the replenished stockpile is 9.0 % finer (or coarser) on the No. 8 sieve than the RAP gradation of the design. Then, $0.20 \times 9.0 \% = 1.8\%$, and the design remains valid.

If, upon replenishment, an existing approved mix design becomes invalid under the above provisions, it may be re-designed and submitted for approval by an approved laboratory using the allowed percentage and gradation of the replenished material in place of the previous percentage and gradation. The re-design shall be based on a minimum of two checkpoints. However, if the maximum percentage of RAP allowed has been reduced by fifteen percent or more, a complete new design shall be required.

VIII. CONTINUAL REPLENISHMENT WITHOUT RE-APPROVAL

At the request of the contractor, a previously approved stockpile may be placed in Continual Replenishment Status and may be replenished any number of times without re-approval provided that:

- a. The contractor shall continue to monitor and test the materials added to the stockpile and shall forward these results to the State Asphalt Design Engineer for every 1000 tons of RAP added to the stockpile.
- b. The Contractor shall certify that the replenishment material will not contain heterogeneous plant waste or contaminants.
- c. The Department shall be notified by letter to the State Bituminous Construction Engineer that the stockpile is being replenished on a continual basis. A stockpile in Continuous Replenishment status may not revert to its previous status.
- d. The amounts of local sand and Group I aggregate in all mixtures shall remain within specified limits. Mix designs containing both RAP and local sand as ingredients will be invalidated if the total sand content exceeds 20.0 percent. Mixtures containing local sand are not permitted on the traveled way of the mainline or ramps of the Interstate System.
- e. The Maximum Percent Allowed (defined in F above) shall be limited to 10.0, 15.0, or 30.0 percent of the total mix, according to the category of continual replenishment that applies, defined as follows:

(1) Ten percent status. The maximum for stockpiles tested and approved at 10.0 percent shall remain at that limit, and mix designs based on a previous higher limit become invalid. However, a *mix design* which calls for up to 5.0 percent more than the percent allowed (15.0 percent or 10.0 percent, as applicable) may, with approval, be adjusted and produced with the lower percent allowed, provided that the production mixture continues to meet all acceptance criteria.

(2) Fifteen percent status. A stockpile tested and approved at 15.0 percent or more may be placed in continual replenishment status at this limit and may not be used in existing mix designs requiring more than fifteen percent RAP, except as provided in (a) above.

(3) Special Replenishment status. A stockpile tested and approved at ≤ 30 percent may be placed in Special Replenishment status subject to the following conditions: (1) The contractor agrees to test each 1,000 ton increment of RAP to be added and to FAX all test results to the Department on a timely basis. The Department will maintain a history of these results on an electronic spreadsheet. (2) Opposite quarters of samples representing every 5,000 tons tested shall be delivered to the Department along with each test result. (3) the RAP stockpile and all replenishment material shall be processed and managed according to recognized industry standards and best practices.

Note: One 20 pound sample bag of RAP for each Continual Replenishment Stockpile shall be submitted to the Central Laboratory at The Office of Materials and Research for petrographic analyses every six months.

The Department may inspect, sample, and test such stockpiles at its discretion and may, upon determining that the stockpile is unsuitable, withdraw approval of the material and all mix designs which include it. Approval of the stockpile may be withdrawn at any time based upon extreme or erratic ingredient proportions, unsuitable ingredients, or poor performance, as determined by the State Materials and Research Engineer. The Department will conduct periodic comparison testing on the opposite quarters of sample submitted by the Contractor for special replenishment approval category. The approval of the stockpile may be withdrawn if erroneous information was found on the contractor's testing and/or improper sampling procedures were involved after a thorough investigation.

IX. DEPLETION OF STOCKPILE AND EXPIRATION OF APPROVAL

When a stockpile has been fully depleted, the Contractor may replenish it within 24 months after the date of depletion; a depleted stockpile not replenished after 24 months will be removed from the approved list and may not be replenished.

Approval of a stockpile may be withdrawn if, in the finding of the State Materials and Research Engineer, the total amount of material used in new mixtures equals the total tonnage of the original stockpile plus all approved replenishments. Six years from the original approval of a stockpile or from its most recent replenishment, a stockpile shall be presumed to be depleted, and its approval shall expire. This shall apply to all stockpiles, regardless of status or history of use.

X. RECORDS

The Contractor shall maintain records at the plant site on all RAP stockpiles. These records shall be available for inspection by representatives of the Department and shall include the following:

- All test results.
- The Department's approval letter for each stockpile and replenishment, together with the Contractor's requests for approval and all data submitted therewith.
- A current drawing of all stockpile locations at the plant site, including unapproved stockpiles, showing stockpile numbers of all stockpiles approved for State work.

XI. RELOCATION OF STOCKPILE

If material from an approved RAP stockpile is to be moved to another location, the contractor shall seek approval from the Department prior to its further use on State projects. A letter request shall be submitted to the Office of Materials and Research indicating the current stockpile number of the material, the total quantity of material to be moved, and the amount, if any, to remain in the current location. The Office of Materials and Research will issue an approval letter with a new stockpile number applicable to the new location and will, at the request of the contractor, revise existing designs to re-identify the stockpile at the new location. The contractor should submit with the request a list of the designs which should be revised.

State Materials Engineer

Director of Construction

CONTRACTOR'S REQUEST FOR RAP STOCKPILE APPROVAL

To: State Bituminous Construction Engineer
Office of Materials and Research
15 Kennedy Drive
Forest Park, Georgia 30297

From: _____

(Name and address of person to receive approval letter)

Date: _____

Subject:
____ Request for Approval of Stockpile, **or**
____ Request for Approval to Replenish Stockpile No. _____

Approval is requested as indicated above. I certify that, to the best of my knowledge, the material conforms to the Specifications and is as represented in the information, test results, and samples submitted herewith.

Plant Number ____ Location _____ County _____

RAP Category:

____ Multiple sources, or
____ Single known pavement source. Show route, project number, and project limits:

Quantity:

Quantity of material _____ tons, based on ____ estimate ____ survey ____ project records ____ other

Replenishment status:

We request continual replenishment status in (check one if applicable): ____ 15% status ; Special
replenishment status.

Name and signature of authorized representative of firm:

Sworn and subscribed before me this ____ day of _____, year _____

Notary Public and seal _____

Enclosures: Test results
Map of stockpile areas